

## DATA TRANSFER SYSTEM AND METHOD OF DATA TRANSFER

The present invention relates to a data transfer system and apparatus and a method of data transfer. More particularly, but not exclusively, it  
5 relates to a data transfer system, apparatus and method for telecommunication with a mobile device.

In the present specification the term "mobile device" encompasses but is not limited to all mobile receivers or transceivers of data, for example  
10 personal digital assistants, mobile telephones and lap top computers. The term "communications network" and "network" encompasses, but is not limited to computer and telephony networks wherein data is passed over the network between entities/devices connected to the network. "Data" is  
15 used to refer to any form of information carried over the network, for example video, telephony, audio or textual information.

As the number of mobile devices connected to public land mobile networks (PLMNs) has increased so has the demand for data transfer over these networks. This has been highlighted by the emergence of wireless  
20 application protocol (WAP) technologies which allow, for example, the access of the Internet from a suitably equipped mobile telephone handset.

A problem associated with large scale data transfer over current PLMN is the low data transfer rates available, for example the current Global  
25 System for Mobile Communications (GSM) network has a maximum data transfer rate of around 9kbits<sup>-1</sup>.

It is envisaged that the next generation of mobile devices, utilising the General Packet Radio System (GPRS), will have a maximum data transfer

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rate of 115k bits<sup>-1</sup> and third generation device data maximum transfer rates could be as high as 2Mbits<sup>-1</sup>.

However, the practically achievable data transfer rates of these systems  
5 will be significantly less than these theoretical maximum vales, for example, GPRS achievable data transfer rates may be as low as 30kbits<sup>-1</sup>.

The disparity between theoretical and achievable data transfer rates is due  
to the nature of the licensed cellular PLMN frequency spectrum. Each  
10 communication channel has a channel capacity associated with it. This channel capacity is shared between all users of a given channel within a cell. Thus, the theoretical maximum data transfer rates refer to a single user of a channel within a cell utilising the channel exclusively. Obviously, this is very seldom the case, particularly in urban  
15 environments where it is possible that there may be in excess of 1,000 users within any given cell.

A further implication of this low data transfer rate is increased costs to  
users as most are billed by their service provider on a time or quantity of  
20 data basis. Clearly low data transfer rates will increase data acquisition times and therefore may increase the cost to the user.

It is an object of the present invention to provide a method of data  
transfer which, at least partly, mitigates at least one of the above-  
25 mentioned disadvantages/problems.

It is a further object of the present invention to provide a data transfer  
system which, at least partly, mitigates at least one of the above-  
mentioned disadvantages/problems.

It is a yet further object of the present invention to provide a high bandwidth data transfer link adapted for use in a data transfer system which, at least partly, mitigates at least one of the above-mentioned disadvantages/problems.

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According to a first aspect of the present invention there is provided method of data transfer including:

10 Providing first and second communication links of differing bandwidths between a network and a mobile device;

Notifying the mobile device of data awaiting transfer thereto from the network via the first, lower bandwidth, communication link;

15 And transferring the data to the mobile device via the second, higher bandwidth, communication link.

The method may include providing the first communication link over a PLMN. The PLMN may provide the first communication link in a cellular structure. The first communication link may be effected via a  
20 GSM network or alternatively via a GPRS or 3G network.

The method may also include providing the second communication link via a wide band short-range (WBSR) network. Short range is taken to  
25 include distances of up to a few tens of metres or up to a few hundreds of metres. The second communication link may be provided via a wireless network or alternatively via a hardwired connection to the mobile device. The second communication link may be provided using any one of IEEE802.11, Bluetooth, or HIPERLAN. The method may further include  
30 providing the second communication link at a fixed location. The second

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The method may further include the step of providing a plurality of second communication links at a plurality of locations, for example in/on telephone boxes, at traffic signals, in/on public transport stations.

5 The method may also include the steps of encrypting the data prior to its transfer to the mobile device; passing a decrypting code to the mobile device via the first communication link; and decrypting the data once received at the mobile device using said decrypting code.

10 According to a further aspect of the present invention there is provided a method of data transfer to a mobile device comprising:

providing a mobile device communicatable with a first communications network and with a second communication network;

15 having the device in communication with the first network and transferring a message to the device via the first network, the message being indicative of the fact that data is desired to be transferred to the device;

putting the device in communication with the second network and transferring the data to the device via the second network.

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Preferably the second network has the capability of transferring the data to the device more cheaply than if it were transferred over the first network. Preferably the first and second networks have telecommunication links to the device of different bandwidths/or data rates: preferably the second network has a bandwidth/data rate that is, 25 significantly higher than that of the first network.

The method may include the step of transferring the message to the device at a bit rate which is lower than the bit rate at which the data is 30 transferred to the device. For example, the second bit rate is at least x5,

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5 Preferably the first network comprises a wireless network, with wireless communication to the mobile device.

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providing first and second communication links of differing  
20 bandwidths between a network and a mobile device;

notifying the network via the first, lower bandwidth,  
25 communication link of data awaiting transfer thereto; and

transferring the data to the network via the second higher bandwidth communication link.

According to a further aspect of the present invention there is provided a data transfer system comprising a network, a mobile device, a first transmitter and a second transmitter, the network being adapted to contain data, the mobile device being adapted to receive signals from both the first and second transmitters, the first transmitter being adapted to transmit a signal to the mobile device when data on the network is available to be transferred to the mobile device, the second transmitter being adapted to transmit data to the mobile device.

The network may be an internet or it may be an intranet. Alternatively it may be the Internet. The network may include a telecommunication network. The network may include a public land mobile network (PLMN) which may be cellular. The network may be a cellular telecommunication network. The network may be a GSM network or, alternatively, it may be a GPRS network or it may be a third generation mobile telecommunication network. The network may have at least two network elements. The network may include at least one server.

The first transmitter may be a relatively low bandwidth (data transfer rate) transmitter. The transmitter may be a GSM transmitter, i.e. 9kbits<sup>-1</sup> maximum bandwidth or it may be a GPRS transmitter, i.e. 115kbits<sup>-1</sup> maximum bandwidth. The first transmitter may operate at a frequency within the range of about 900 MHz to about 1900 MHz. Alternatively or additionally it may generate at a frequency at or near the 2 GHz band.

The first transmitter may also be capable of receiving signals from the mobile device. The first transmitter may be a long range transmitter, for example, have a useable range in excess of 100m, or excess of 500m, or in excess of a kilometre or more, or several kilometers or more. Typically the first transmitter will have a range of at least 1km, more typically at least a 5km. The first transmitter may be a PLMN

The signal transmitted by the first transmitter may be a digitally encoded signal. The signal may be a textual message, for example a short message service (SMS) signal. The signal may be an audible or a visual signal. The signal may be in the form of a wireless application protocol (WAP) signal. The purpose of the transmitted signal may be to alert a user of the mobile device that data on the network is available for download to the mobile device, in use.

A plurality of second transmitters may be distributed geographically. The geographic distribution of the second transmitters serves to increase  
30 accessibility by users. The second transmitters may be located on/in

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(e.g. mobile devices which do have GPS, or fixed devices, e.g. street furniture (e.g. lamp post, traffic lights etc.)) by communication over WBSR links, giving an accuracy of a few tens of metres. This allows a mobile device user to be directed to the closest/most convenient second transmitter.

The data may be encrypted. A key may be required to decrypt the data. The key may be a public key. The public key may originate from the public key infrastructure. The use of encryption and public keys increases the security of the data downloaded onto the mobile device. The data may be electronically watermarked. There may be an electronic authentication certificate associated with the public key.

According to a yet further aspect of the present invention there is provided a converter device adapted for use with a network having an interface, suitable to interface with a mobile device and a wide band communication link such that the device is capable of allowing the mobile device to perform any of the preceding methods according to the present invention, thereby converting a mobile device into a mobile device in accordance with the present invention.

According to a yet further aspect of the present invention there is provided a wide bandwidth short range transceiver adapted to mediate a flow of data between a mobile device and a network in response to a request from said mobile device, the mobile device having received a notification that the data is awaiting transfer via a wireless network, e.g. cellular network or satellite based.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

A data transfer system and a method of data transfer, each embodying the invention, will now be described, by way of non-limiting example, with  
5 reference to the accompanying diagrammatic drawings, in which:

**Figure 1** is a diagram of a known prior art data transfer system comprising a network, for example the internet, connected to a PLMN which transfers data from the network to a mobile device;

**Figure 2** is a diagram of a data transfer system comprising a network, to both a PLMN and a wide bandwidth short range (WBSR) base station and a mobile device capable of communicating with both the PLMN and the WBSR wireless link;

**Figure 3** is a schematic representation of a geographically distributed array of WBSR base stations linked to a network;

**Figure 4** is a flow chart illustrating a method of data transfer of the system of Figure 2 including optional public key security;

**Figure 5** is a schematic representation of a data transfer system according to the present invention, incorporating GPS; and

**Figure 6** is a schematic representation of a data transfer system according to the present invention capable of position location.

Figure 1 shows a mobile device 1 (in this case a personal digital assistant, PDA) communicable with a PLMN2 via a wireless link 3. A remote  
30 device 4 wishing to send the PDA 1 data accesses the PLMN2 and sends

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locates the mobile device 18 within its cellular structure and passes the message to an appropriate transceiver station 26. The message comprises a notification that data is awaiting transfer from the network 12 to the device 18 and this message is passed from the station 26 to the first  
5 transceiver 19 of the device 18 (notified by the arrow A in Figure 2) by wireless transmission.

Upon receipt of a "data is waiting" message a user of the mobile device 18 decides whether they wish to receive the data from the network 12 via  
10 the low bandwidth PLMN 14 connection, this typically having a data transfer rate of 9kbits<sup>-1</sup> for GSM and an average data transfer rate of 30 kbits<sup>-1</sup> for GPRS, or whether the user wishes to move to within range of a WBSR base station 16 (if they are not already in range).

15 The message transmitted to the device 18 via the wireless link A may include one or more of the following: the amount of data to be transmitted; the time it will take to transmit the data via the PLMN14; the cost of the telephone call/telecommunication charge if they choose to transmit the data to the device via the PLMN; an indication of the level of  
20 urgency that the sender of the data thinks the recipient should give to receiving the data; the location of, directions to, distance to, or time to, at least one (preferably the nearest) WBSR base station (or the WBSR base station that is estimated will enable the user to download the data fastest). Another embodiment also gives distance/time to a selection of  
25 nearest WBSR base stations - some may have a queue or better data transfer rates.

Should the user decide to use the PLMN 14 connection the transfer of data from the network 12 to the device 18 proceeds according to the prior  
30 art configuration discussed hereinbefore.

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communication with the station 16, the data being stored at the WBSR station 16 for downloading. This may allow for slower rates of data transfer to the WBSR station because there will be a delay in the device 18 requesting the data from the station 18 because it will have to get there first (within the physical proximity).

As the WBSR base station 16 in many embodiments acts only as a conduit for the flow of data it may require only a small amount of buffer memory. This low memory requirement would increase the speed and reduces the power requirements, of the WBSR base station.

A further refinement of the present invention allows a user of the mobile device to transfer data onto the network 12. The user enters or loads the data onto the mobile device 18. The mobile device 18 can determine whether it is preferable to upload the data onto the network via the PLMN 14 or the WBSR base station 16. This decision may be made from a pre-programmed "cost-benefit" type analysis which may include such criteria as amount of data to be uploaded, estimated time/cost of upload via PLMN 14 and distance to the nearest/most convenient WBSR base station 16. The data to be uploaded can, in an embodiment, be split into a first, minor, portion which is transmitted via the PLMN 14 and a second, major, portion which is transmitted when the mobile device 18 is within range, typically a few tens of metres or a WBSR band station 16. Alternatively, the data could be onto the network 12 in a single block via either the PLMN 14 or the WBSR base station 16. Alternatively, the data could be uploaded onto the network 12 in a single block via either the PLMN 14 or the WBSR base station 16. There may be software at the base station which assesses the data and generates a suitable information "data waiting" message to be sent by conventional mobile phone e.m. spectrum.

5 The wireless technologies used in the WBSR base station to mobile device data transfer are typically, one of Bluetooth, IEEE 802.11 or HIPERLAN.

It will be appreciated that the mobile device need not have means for communicating with a WBSR base station mounted integrally therewith, for example such means could be mounted upon a card which is inserted in a port in the mobile device. Alternatively the communication means may take the form of a computer program which re-programs the mobile device to allow it to interface with a WBSR base station.

Figure 3 shows a schematic representation geographically distributed array of WBSR base stations 16 connected to a network 12. The stations 16 are mounted on various platforms including a traffic signal 28, a telephone kiosk 30, a turnstile 32, for example at a sports stadium or subway station, and at a rail station (or other public transport depot) 34. The PLMN 14 could notify a user that a party wishes to video conference with them (as a common example of a high data-rate activity). The user could then locate a WBSR 16a which has been adapted for video conferencing by the provision of a screen 36, camera 38, microphone 40, and a booth 41 (for privacy) or could video conference via a computer 42 or via their mobile device 18 if it had a camera, screen microphone, and

The WBSR base stations can be situated in any area where there will be a significant density of potential users, or where a lot of users will pass by (e.g. a gateway entrance to a building or mall). The number of WBSR base stations will depend upon a variety of factors including increasing the number of transceivers in areas where there is a high density of users, such as shopping malls, in order to maintain high data transfer rates.

An attraction of such sites as telephone kiosks is that they already have telecommunication links. An attraction of traffic signals and turnstiles (e.g. subway turnstiles) is that they already have a power-supply. Also at traffic signals the traffic may come to a standstill, which will facilitate data transfer; the mobile device will dwell in the vicinity of the base station for a significant amount of time, time enough for data transfer. Another possible site for mounting the base stations 16 is at post boxes.

As shown in Figure 5, and WBSR base stations 16 the mobile device 18 may have respective GPS transceivers 44, 45 built into them. These GPS transceivers 44, 45 allow the mobile device 18 to estimate which WBSR base station 16 is the nearest to the present position of the mobile device 18. It is possible that the mobile device 18 may have a map 44 of its locale programmed into it (or downloadable to it) and will be able to display the map showing locations of the WBSR base stations 16 in order to direct the user to the nearest/most convenient WBSR base station 16. The map may be automatically updated via the PLMN 14 at such time as the mobile device 18 enters a different cell. Alternatively, directions (or the address or location) may be displayed/audio presented to the user

without actually displaying a map. Some mobile devices may not have a display screen.

5 The mobile device 18 may have a "learn" facility whereby it learns a users usual route or a daily pattern of movement and can therefore direct the data to a convenient WBSR base station 16. This convenient WBSR base station 16 may not be the nearest base station but one may be passed by the user during their ordinary daily movements.

10 Alternatively, as shown in Figure 6, the mobile device 18 may not have position awareness but may communicate via a WBSR link 49 with fixed bodies, for example street lights 48, traffic signals 50, or turnstiles 52, which have GPS transceivers 54 mounted thereupon. The mobile device 18 can use the positional data obtained from the fixed bodies in order to  
15 estimate its own position and which WBSR base station 16 is the nearest/most convenient. The device 18 could additionally or alternatively communicate with other mobile devices that do have GPS facility and know their position.

20 Figure 4 is a flow chart showing the processes involved in the transfer of data according to the method of the present invention.

25 Data is put onto the network in some way (not shown), data which is resident upon the network 12 (step 100) and is addressed to the mobile device 18 causes a connection to be established between the network 12 and the PLMN 14 (step 101) and prompts the formation of a connection between the PLMN 14 and the mobile device 18 (step 102).

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5 Should the user choose to download the data via the PLMN 14. The data is transmitted in the conventional, prior art, way (step 105).

15 If it is decided not to encrypt the data the mobile device 18 must be brought with the transmission range of a WBSR base station 16 (step 107) and a request for the data from the network 12 made. (step 108). Typically, it may be necessary to be within a few tens of metres of the base station 16 for telecommunication with it (e.g. within 10m or so).

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The data is then passed to the WBSR base station via the connection and is transmitted to the mobile device 18 via the WBSR base station (step 110).

If the option to encrypt the data is chosen the data is encrypted using a known technique such as the public key infrastructure (step 111) and the decryption key and authentication certificate is passed over the PLMN to the mobile device (step 112). The establishing of a connection and  
5 transmission of data is the same as for the non-encrypted case (steps 113, 114, 115, 116).

The encrypted data is decrypted at the mobile device using the decryption key passed over the PLMN (step 117).

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It will be appreciated that in some embodiments the WBSR stations 16 communicate with the mobile device 18 using the unlicensed spectrum of wavelengths - i.e. free (no payment to licensor of spectrum/reserved frequencies). Thus a large amount of data can be transferred at a lower  
15 cost than using the PLMN for the whole of the data. Just a short alerting message can be sent on the expensive PLMN and the vast majority of the data sent on the much cheaper Internet/other cheap network to the right base station 16, which will then use unlicensed spectrum. This means that if cost of the wireless transmission of the data is a significant factor  
20 in the overall cost of transferring the data the wireless part of the data transfer can be done over the unlicensed spectrum, and so high data rates are not so important since a long "call" is not costing much.

In other embodiments the mobile device and the base station may  
25 communicate via the licensed spectrum instead of the unlicensed (or as well as using unlicensed spectrum). For example, preferential prices for use of one or more licensed bands may be available for the base station - mobile device communication. If this were so there would still be a cost saving for the user to take their mobile device to the base station.

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